

1. An isolated polynucleotide encoding an *alpha*-farnesene synthase.
- 5 2. A polynucleotide as claimed in claim 1 wherein the polynucleotide encodes a polypeptide comprising at least one repeat of DDXXD and (L,V)(V,L,A)(N,D)D(L,I,V)X(S,T)XXXE, wherein X is any amino acid.
- 10 3. An isolated polynucleotide as claimed in claim 1 having the sequence of SEQ ID NO:1 or a fragment or variant thereof wherein the fragment or variant encodes a polypeptide with *alpha*-farnesene synthase activity.
4. An isolated polynucleotide as claimed in claim 3 wherein the sequence has at least 70% identity to the nucleotide sequence of SEQ ID NO:1.
- 15 5. An isolated polynucleotide as claimed in claim 3 wherein the sequence has at least 90% identity to the nucleotide sequence of SEQ ID NO:1.
6. An isolated polynucleotide as claimed in claim 3 wherein the sequence has at least 20 95% identity to the nucleotide sequence of SEQ ID NO:1.
7. An isolated polynucleotide as claimed in claim 3 wherein the nucleotide sequence is that of SEQ ID NO:1.
- 25 8. An isolated polynucleotide encoding the polypeptide of SEQ ID NO:2 or encoding a variant or a fragment of that sequence which has *alpha*-farnesene synthase activity.
9. An isolated polynucleotide as claimed in claim 8 wherein the polypeptide has at least 70% identity with the amino acid sequence of SEQ ID NO:2.
- 30 10. An isolated polynucleotide as claimed in claim 8 wherein the polypeptide has at least 90% identity with the amino acid sequence of SEQ ID NO:2.

11. An isolated polynucleotide as claimed in claim 8 wherein the polypeptide has at least 95% identity with the amino acid sequence of SEQ ID NO:2.

12. An isolated polynucleotide as claimed in claim 8 wherein the polypeptide has the sequence of SEQ ID NO:2.

13. An isolated *alpha*-farnesene synthase polypeptide.

14. An isolated *alpha*-farnesene synthase having the sequence of SEQ ID NO:2 or a fragment or variant thereof with *alpha*-farnesene synthase activity.

15. An isolated *alpha*-farnesene synthase as claimed in claim 14 wherein the amino acid sequence has at least 70% identity with the sequence of SEQ ID NO:2.

16. An isolated *alpha*-farnesene synthase as claimed in claim 14 wherein the amino acid sequence has at least 90% identity with the sequence of SEQ ID NO:2.

17. An isolated *alpha*-farnesene synthase as claimed in claim 14 wherein the amino acid sequence has at least 95% identity with the sequence of SEQ ID NO:2.

18. An isolated *alpha*-farnesene synthase as claimed in claim 14 wherein the amino acid sequence is a mature sequence derived from SEQ ID NO:2.

19. A genetic construct comprising a polynucleotide of any one of claims 1 to 12.

20. A genetic construct comprising in the 5'-3' direction an open reading frame polynucleotide encoding a polypeptide of any one of claims 13 to 18.

21. A genetic construct as claimed in claim 20 further comprising a promoter sequence.

22. A genetic construct as claimed in claim 21 which further comprises a termination sequence.

23. A genetic construct as claimed in claim 22 wherein the sequence of the encoded polypeptide has the amino acid sequence of SEQ ID NO:2 or a fragment thereof with *alpha*-farnesene activity.
- 5 24. A genetic construct comprising in the 5'-3' direction a polynucleotide which hybridizes to a polynucleotide encoding a polypeptide of any one of claims 13 to 18.
25. A genetic construct as claimed in claim 24 further comprising a promoter sequence.
- 10 26. A genetic construct as claimed in claim 25 which comprises a termination sequence
27. A genetic construct as claimed in claim 26 wherein the sequence of the encoded polypeptide is has the amino acid sequence of SEQ ID NO:2 or a fragment thereof with *alpha*-farnesene activity.
- 15 28. A vector comprising a genetic construct of any one of claims 19 to 27.
29. A host cell comprising a genetic construct of any one of claims 19 to 27.
- 20 30. A transgenic plant cell which includes a genetic construct of any one of claims 19 to 27.
31. A transgenic plant comprising a plant cell as claimed in claim 30.
- 25 32. A method of preparing *alpha*-farnesene comprising the steps of
- (a) culturing a cell which has been genetically modified with a polynucleotide any one of claims 1-12 to provide increased *alpha*-farnesene synthase activity;
 - (b) providing the cell with farnesyl diphosphate if necessary; and
 - (c) separating the *alpha*-farnesene produced.
- 30 33. A method for modulating the *alpha*-farnesene production of a plant, the method comprising: increasing or decreasing expression of *alpha*-farnesene synthase wherein said increasing or decreasing is achieved by genetic modification to alter the expression of a gene encoding an *alpha*-farnesene synthase .

34. A method as claimed in claim 33 wherein the polypeptide comprises a polypeptide with the sequence of SEQ ID NO: 2.

35. A method for modulating *alpha*-farnesene production in a plant, the method comprising of:

- (a) introducing into the plant, a genetic construct of claims 19-27; and
- (b) transcriptionally expressing the polynucleotide in the plant.

36. A method for modulating *alpha*-farnesene production in a plant, the method comprising of

- (a) introducing into the plant, a DNA genetic construct of claims 19-27; and
- (b) expressing the polypeptide in the plant.

37. A polynucleotide having at least 15 contiguous nucleotides from SEQ ID NO: 1

38. A method of selecting a plant with altered *alpha*-farnesene content comprising the steps of:

- (a) contacting polynucleotides from at least one plant with at least one polynucleotide comprising at least 15 contiguous nucleotides of the polynucleotide of claim 1 to assess the expression of *alpha*-farnesene synthase; and
- (b) selecting a plant showing altered expression.

39. A method as claimed in claim 35 wherein the polynucleotide has at least 15 contiguous nucleotides from SEQ ID NO: 1 and the plant is an apple plant.

40. A method for preparing *alpha*-farnesene comprising:

- (a) obtaining a polypeptide as claimed in any one of claims 13-18; and
- (b) incubating farnesyl diphosphate in the presence of the polypeptide, and
- (c) separating the *alpha*-farnesene produced.